

### Claims

1. Antimicrobial pigments, obtainable by agitating a suspension comprising one or more inorganic pigments and silver oxide as antimicrobial compound.  
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2. Antimicrobial pigments according to claim 1, characterized in that the inorganic pigment is platelet-shaped, spherical or needle-shaped.
- 10 3. Antimicrobial pigments according to claim 1, characterized in that the inorganic pigments are inorganic white pigments, inorganic coloured pigments, inorganic black pigments, effect pigments, luminous pigments, magnesium carbonate, mica,  $\text{SiO}_2$ ,  $\text{TiO}_2$ , aluminium oxide, glass, micaceous iron oxide, oxidised graphite, aluminium oxide-coated  
15 graphite, basic lead carbonate, barium sulphate, chromium oxide or  $\text{MgO}$ .
4. Antimicrobial pigments according to claim 3, characterized in that the effect pigments are based on substrates.  
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5. Antimicrobial pigments according to claim 4, characterized in that the substrates are selected from the group of natural or synthetic mica,  $\text{SiO}_2$ ,  $\text{TiO}_2$ ,  $\text{BiOCl}$ , Aluminium oxide, glass, micaceous iron oxide, graphite, oxidised graphite, aluminium oxide coated graphite, basic lead  
25 carbonate, barium sulphate, chromium oxide,  $\text{BN}$ ,  $\text{MgO}$ ; magnesium fluoride,  $\text{Si}_3\text{N}_4$ , and/or metals.
6. Antimicrobial pigments according to claim 5, characterized in that the substrates additionally are coated with one or more layers of  $\text{BiOCl}$   
30 and/or transparent, semitransparent or opaque, selectively or nonselectively absorbing or nonabsorbing metal oxides, metal

suboxides, metal oxide hydrates, metals, metal nitrides, metal oxynitrides, metal fluorides and/or mixtures of these materials.

- 5 7. Antimicrobial pigments according to claim 6, characterized in that the one or more layers of BiOCl and/or transparent, semitransparent or opaque, selectively or nonselectively absorbing or nonabsorbing metal oxides, metal suboxides, metal oxide hydrates, metals, metal nitrides, metal oxynitrides, metal fluorides and/or mixtures of these materials are arranged as alternating layers of transparent, semitransparent or
- 10 opaque, selectively or nonselectively absorbing or nonabsorbing metal oxides, metal suboxides, metal oxide hydrates, metals, metal nitrides, metal oxynitrides, metal fluorides and/or mixtures of these materials or BiOCl with a refractive index  $n > 1.8$  and transparent, semitransparent or opaque, selectively or nonselectively absorbing or nonabsorbing
- 15 metal oxides, metal suboxides, metal oxide hydrates, metals, metal nitrides, metal oxynitrides, metal fluorides and/or mixtures of these materials with a refractive index  $n \leq 1.8$ .
- 20 8. Antimicrobial pigments according to claims 6 and 7, characterized in that the outer layer of the inorganic pigment comprises a transparent, semitransparent or opaque, selectively or nonselectively absorbing or nonabsorbing metal oxide, metal suboxide, metal oxide hydrate and/or mixture of these materials.
- 25 9. Antimicrobial pigments according to claim 6 to 8, characterized in that the transparent, semitransparent or opaque, selectively or nonselectively absorbing or nonabsorbing metal oxides, metal suboxides, metal oxide hydrates, metals, metal nitrides, metal oxynitrides, metal fluorides and/or mixtures of these materials
- 30 additionally contain organic and/or inorganic colorants or elements as dopant.

10. Antimicrobial pigments according to claim 1, characterized in that the inorganic pigment comprises spherical particles or spherical capsules of metal oxides, BiOCl, magnesium carbonate, graphite, oxidised graphite, aluminium oxide-coated graphite, basic lead carbonate, barium sulphate, BN, magnesium fluoride,  $\text{Si}_3\text{N}_4$  and/or metals.
11. Antimicrobial pigments according to claim 10, characterized in that the spherical particles or capsules are coated with one or more layers of transparent, semitransparent or opaque, selectively or nonselectively absorbing or nonabsorbing metal oxides, metal suboxides, metal oxide hydrates, metals, metal nitrides, metal oxynitrides, metal fluorides and/or mixtures of these materials.
12. Antimicrobial pigments according to any of claims 1 to 11, characterized in that they are additionally coated with a protective coating layer.
13. Antimicrobial pigments according to claim 12, characterized in that the protective coating is selected from silica, silicates, borosilicates, aluminosilicates, alumina, aluminum phosphate, or mixtures thereof.
14. Antimicrobial pigments according to claim 1, characterized in that L, a and b values of the employed inorganic pigments and the antimicrobial pigments have a maximum deviation for the L value of  $-6 \leq \Delta L \leq 6$ , for the a value of  $-5 \leq \Delta a \leq 5$  and for the b value of  $-5 \leq \Delta b \leq 5$ .
15. Antimicrobial pigments according to claim 1, characterized in that the silver oxide is substituted by silver halogenide, silver nitrate, silver sulfate, silver carboxylates, silver carbonate, silver citrate, copper oxides, copper sulfide, copper nitrate, copper carbonate, copper sulfate, copper halogenides, copper carboxylates, zinc oxide, zinc

sulfide, zinc silicate, zinc acetate, zinc chloride, zinc nitrate, zinc sulfate, zinc gluconate, zinc citrate, zinc phosphate, zinc propionate, zinc salicylate, zinc lactate, zinc oxalate, zinc iodate, zinc iodide or combinations thereof.

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16. Antimicrobial pigments according to claim 1, characterized in that the amount of the antimicrobial compound is in the range of 0.001 to 10 % by weight, preferably between 0.005 and 5% by weight, based on the inorganic pigment.

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17. Method for the preparation of antimicrobial pigments comprising the agitation of a suspension comprising one or more inorganic pigments and silver oxide as antimicrobial compound.

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18. Method according to claim 17, characterized in that the preparation is performed in water, ethanol, methanol, 1-propanol, 2-propanol and/or mixtures thereof.

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19. Method according to claim 17 or 18, characterized in that the preparation temperature is between 10 and 60°C.

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20. Method according to claims 17 to 19, characterized in that the silver oxide is substituted by silver halogenide, silver nitrate, silver sulfate, silver carboxylates, silver carbonate, silver citrate, copper oxides, copper sulfide, copper nitrate, copper carbonate, copper sulfate, copper halogenides, copper carboxylates, zinc oxide, zinc sulfide, zinc silicate, zinc acetate, zinc chloride, zinc nitrate, zinc sulfate, zinc gluconate, zinc citrate, zinc phosphate, zinc propionate, zinc salicylate, zinc lactate, zinc oxalate, zinc iodate, zinc iodide or combinations thereof.

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21. Method according to claims 17 to 20, characterized in that the amount of the antimicrobial compound is in the range of 0.001 to 10 % by

weight, preferably between 0.005 and 5% by weight, based on the inorganic pigment.

- 5           22. Method according to claims 17 to 20, characterized in that the antimicrobial pigments are further coated with a protective coating layer.
23. Method according to claim 22, characterized in that the protective coating is selected from silica, silicates, borosilicates, aluminosilicates, alumina, aluminum phosphate, or mixtures thereof.
- 10           24. Method according to claim 22 or 23, characterized in that the coating is performed wet-chemically.
25. Use of antimicrobial pigments according to claim 1 for the inhibition of the growth and/or progeny of microorganisms.
- 15           26. Use of pigments according to claim 1 in formulations or applications.
27. Use according to claim 26, characterized in that the formulation and/or application is selected from the group of cosmetic formulations, paints, inks, food colouring, home care products, animal care products, products for personal and work hygiene, contact lenses, chromatography materials, medical equipment, protective topicals, pharmaceutical, especially dermatological formulations, lacquers, coatings and/or plastics.
- 20           28. Use according to claim 26 characterized in that the antimicrobial pigments are in combination with preservatives and antimicrobial agents.
- 25           29. Use according to claim 26 characterized in that the antimicrobial pigments are in combination with antibiotics.
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30. Use according to claim 29, characterized in that the antibiotics are selected from the group of Beta-lactam, Vancomycin, Macrolides, Tetracyclines, Quinolones, Fluoroquinolones, Nitrated compounds, Aminoglycosides, Phenicol, Lincosamids, Synergistins, Fosfomycin, Fusidic acid, oxazolidinones, Rifamycins, Polymixynes, Gramicidins, Tyrocydine, Glycopeptides, Sulfonamides or Trimethoprim
31. Use of antimicrobial pigments according to claim 1 for oral care.
32. Use of antimicrobial pigments according to claim 1 for the prophylaxis and/or treatment of herpes.
33. Formulations and/or applications comprising antimicrobial pigments according to claim 1.
34. Formulations or applications according to claim 33, characterized in that the formulation comprises at least one compound selected from the group consisting of suitable substrates for microorganisms, wherein the suitable substrate for microorganisms is preferably selected from the group consisting of alkanes, alkenes, alkynes, with or without functional groups, sugars, polyols, alcohols, saturated or unsaturated carboxylic acids, proteins, amino acids, water, fatty acids, waxes, fats, mineral oils, salts, hormones, steroids, vitamins and/or derivatives or salts thereof.